

1

SEQUENCE LISTING

<110> BASF Aktiengesellschaft

<120> D6-acetylenase and D6-desaturase from Ceratodon
purpureus

<130> 99 1388

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<150> 19925718.3

<151> 1999-06-07

<160> 12

<170> PatentIn Vers. 2.0

<210> 1

<211> 2040

<212> DNA

<213> Ceratodon purpureus

<220>

<221> CDS

<222> (176)..(1627)

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tcagggtcga tcaggttatt ctgaaaaagg ctgcgtctgt gagcagtttg caaaa atg 178
Met

1

gcc ctc gtt acc gac ttt ctg aac ttt ctg ggc acg aca tgg agc aag 226
Ala Leu Val Thr Asp Phe Leu Asn Phe Leu Gly Thr Thr Trp Ser Lys
5 10 15tac agc gtg tac acc cat agc tat gct gga aac tat ggg cct act ttg 274
Tyr Ser Val Tyr Thr His Ser Tyr Ala Gly Asn Tyr Gly Pro Thr Leu
20 25 30aag cac gcc aaa aag gtt tct gct caa ggt aaa act gcg gga cag aca 322
Lys His Ala Lys Lys Val Ser Ala Gln Gly Lys Thr Ala Gly Gln Thr
35 40 45ctg aga cag aga tcg gtg cag gac aaa aag cca ggc act tac tct ctg 370
Leu Arg Gln Arg Ser Val Gln Asp Lys Lys Pro Gly Thr Tyr Ser Leu

2

50	55	60	65	
gcc gat gtt gct tct cac gac agg cct gga gac tgc tgg atg atc gtc				418
Ala Asp Val Ala Ser His Asp Arg Pro Gly Asp Cys Trp Met Ile Val				
	70	75	80	
aaa gag aag gtg tat gat att agc cgt ttt gcg gac gac cac cct gga				466
Lys Glu Lys Val Tyr Asp Ile Ser Arg Phe Ala Asp Asp His Pro Gly				
	85	90	95	
ggg acg gta att agc acc tac ttt ggg cgg gat ggc aca gac gtt ttc				514
Gly Thr Val Ile Ser Thr Tyr Phe Gly Arg Asp Gly Thr Asp Val Phe				
	100	105	110	
gca aca ttc cat cca cct gcc gca tgg aag caa ctc aat gac tac tac				562
Ala Thr Phe His Pro Pro Ala Ala Trp Lys Gln Leu Asn Asp Tyr Tyr				
	115	120	125	
att gga gac ctt gct agg gaa gag ccc ctt gat gaa ttg ctt aaa gac				610
Ile Gly Asp Leu Ala Arg Glu Glu Pro Leu Asp Glu Leu Leu Lys Asp				
	130	135	140	145
tac aga gat atg aga gcc gag ttt gtt aga gaa ggg ctt ttc aag agt				658
Tyr Arg Asp Met Arg Ala Glu Phe Val Arg Glu Gly Leu Phe Lys Ser				
	150	155	160	
tcc aag gcc tgg ttc ctg ctt cag act ctg att aat gca gct ctc ttt				706
Ser Lys Ala Trp Phe Leu Leu Gln Thr Leu Ile Asn Ala Ala Leu Phe				
	165	170	175	
gct gcg agc att gcg act atc tgt tac gac aag agt tac tgg gct att				754
Ala Ala Ser Ile Ala Thr Ile Cys Tyr Asp Lys Ser Tyr Trp Ala Ile				
	180	185	190	
gtg ctg tca gcc agt ttg atg ggt ctc ttc gtc caa cag tgt gga tgg				802
Val Leu Ser Ala Ser Leu Met Gly Leu Phe Val Gln Gln Cys Gly Trp				
	195	200	205	
ctt gcc cat gat ttc ctt cat caa cag gtc ttt gag aac cgt acc gcg				850
Leu Ala His Asp Phe Leu His Gln Gln Val Phe Glu Asn Arg Thr Ala				
	210	215	220	225
aac tcc ttc ttt ggc tat ttg ttc ggc aat tgc gtg ctt ggc ttt agt				898
Asn Ser Phe Phe Gly Tyr Leu Phe Gly Asn Cys Val Leu Gly Phe Ser				
	230	235	240	
gta tca tgg tgg agg acg aag cac aac att cat cat act gct ccg aat				946
Val Ser Trp Trp Arg Thr Lys His Asn Ile His His Thr Ala Pro Asn				
	245	250	255	
gag tgc gac gaa cag tac aca cct cta gac gaa gac att gat act ctc				994

3

Glu Cys Asp Glu Gln Tyr Thr Pro Leu Asp Glu Asp Ile Asp Thr Leu	
260 265 270	
ccc atc att gcc tgg agc aag gaa att ttg gcc acc gtt gag agc aag	1042
Pro Ile Ile Ala Trp Ser Lys Glu Ile Leu Ala Thr Val Glu Ser Lys	
275 280 285	
aga att ttg cga gtg ctt caa tat cag cac tac atg att ctg cct cta	1090
Arg Ile Leu Arg Val Leu Gln Tyr Gln His Tyr Met Ile Leu Pro Leu	
290 295 300 305	
ttg ttc atg gcc cgg tac agt tgg act ttt gga agt ttg ctc ttc aca	1138
Leu Phe Met Ala Arg Tyr Ser Trp Thr Phe Gly Ser Leu Leu Phe Thr	
310 315 320	
ttc aat cct gat ttg agc acg acc aag gga ttg ata gag aag gga aca	1186
Phe Asn Pro Asp Leu Ser Thr Thr Lys Gly Leu Ile Glu Lys Gly Thr	
325 330 335	
gtt gct ttt cac tac gcc tgg ttc agt tgg gct gcg ttc cat att ttg	1234
Val Ala Phe His Tyr Ala Trp Phe Ser Trp Ala Ala Phe His Ile Leu	
340 345 350	
ccg ggt gtc gct aag cct ctt gcg tgg atg gta gca act gag ctt gtg	1282
Pro Gly Val Ala Lys Pro Leu Ala Trp Met Val Ala Thr Glu Leu Val	
355 360 365	
gcc ggt ttg ttg ttg gga ttc gtg ttt acg ttg agt cac aat gga aag	1330
Ala Gly Leu Leu Leu Gly Phe Val Phe Thr Leu Ser His Asn Gly Lys	
370 375 380 385	
gag gtt tac aat gaa tcg aag gac ttc gtg aga gcc cag gtt att acc	1378
Glu Val Tyr Asn Glu Ser Lys Asp Phe Val Arg Ala Gln Val Ile Thr	
390 395 400	
acc cgt aac acc aag cga ggc tgg ttc aac gat tgg ttc act ggg gga	1426
Thr Arg Asn Thr Lys Arg Gly Trp Phe Asn Asp Trp Phe Thr Gly Gly	
405 410 415	
ctc gac acc cag att gag cat cac ctg ttt cca aca atg ccc agg cac	1474
Leu Asp Thr Gln Ile Glu His His Leu Phe Pro Thr Met Pro Arg His	
420 425 430	
aac tac ccc aag atc gca cct cag gtc gag gct ctt tgc aag aag cac	1522
Asn Tyr Pro Lys Ile Ala Pro Gln Val Glu Ala Leu Cys Lys Lys His	
435 440 445	
ggc ctc gag tac gat aat gtc tcc gtc gtt ggt gcc tct gtc gcg gtt	1570
Gly Leu Glu Tyr Asp Asn Val Ser Val Val Gly Ala Ser Val Ala Val	
450 455 460 465	

4

gtg aag gcg ctc aag gaa att gct gat gaa gcg tca att cgg ctt cac 1618
 Val Lys Ala Leu Lys Glu Ile Ala Asp Glu Ala Ser Ile Arg Leu His
 470 475 480

gct cac taa gaaatcgctg aactttgact attcattttt ttgcctggc 1667
 Ala His

tacctcaaat gttcgggagc aggtgcttgg cagtgtgttc aaccggagcg cactgaaaat 1727

gtgcagaatc catttccaga aattaccatt cctagctaaa tcttcttttt accaggctcg 1787

atatatgaaa cttttttgat gcaacaagta gcattcaatt gaagacattg ttcgagatat 1847

aattcgcagt gtttctattc agcgggcata cgtactagtc catatcggcg gttgccgaga 1907

gtttacatta ttagttggca caacgagtag atctagtgtg aatttctatt tccgcatgta 1967

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<210> 2

<211> 483

<212> PRT

<213> Ceratodon purpureus

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 20 25 30

Leu Lys His Ala Lys Lys Val Ser Ala Gln Gly Lys Thr Ala Gly Gln
 35 40 45

Thr Leu Arg Gln Arg Ser Val Gln Asp Lys Lys Pro Gly Thr Tyr Ser
 50 55 60

Leu Ala Asp Val Ala Ser His Asp Arg Pro Gly Asp Cys Trp Met Ile
 65 70 75 80

Val Lys Glu Lys Val Tyr Asp Ile Ser Arg Phe Ala Asp Asp His Pro
 85 90 95

Gly Gly Thr Val Ile Ser Thr Tyr Phe Gly Arg Asp Gly Thr Asp Val
 100 105 110

Phe Ala Thr Phe His Pro Pro Ala Ala Trp Lys Gln Leu Asn Asp Tyr
 115 120 125

5

Tyr Ile Gly Asp Leu Ala Arg Glu Glu Pro Leu Asp Glu Leu Leu Lys
 130 135 140

Asp Tyr Arg Asp Met Arg Ala Glu Phe Val Arg Glu Gly Leu Phe Lys
 145 150 155 160

Ser Ser Lys Ala Trp Phe Leu Leu Gln Thr Leu Ile Asn Ala Ala Leu
 165 170 175

Phe Ala Ala Ser Ile Ala Thr Ile Cys Tyr Asp Lys Ser Tyr Trp Ala
 180 185 190

Ile Val Leu Ser Ala Ser Leu Met Gly Leu Phe Val Gln Gln Cys Gly
 195 200 205

Trp Leu Ala His Asp Phe Leu His Gln Gln Val Phe Glu Asn Arg Thr
 210 215 220

Ala Asn Ser Phe Phe Gly Tyr Leu Phe Gly Asn Cys Val Leu Gly Phe
 225 230 235 240

Ser Val Ser Trp Trp Arg Thr Lys His Asn Ile His His Thr Ala Pro
 245 250 255

Asn Glu Cys Asp Glu Gln Tyr Thr Pro Leu Asp Glu Asp Ile Asp Thr
 260 265 270

Leu Pro Ile Ile Ala Trp Ser Lys Glu Ile Leu Ala Thr Val Glu Ser
 275 280 285

Lys Arg Ile Leu Arg Val Leu Gln Tyr Gln His Tyr Met Ile Leu Pro
 290 295 300

Leu Leu Phe Met Ala Arg Tyr Ser Trp Thr Phe Gly Ser Leu Leu Phe
 305 310 315 320

Thr Phe Asn Pro Asp Leu Ser Thr Thr Lys Gly Leu Ile Glu Lys Gly
 325 330 335

Thr Val Ala Phe His Tyr Ala Trp Phe Ser Trp Ala Ala Phe His Ile
 340 345 350

Leu Pro Gly Val Ala Lys Pro Leu Ala Trp Met Val Ala Thr Glu Leu
 355 360 365

Val Ala Gly Leu Leu Leu Gly Phe Val Phe Thr Leu Ser His Asn Gly
 370 375 380

Lys Glu Val Tyr Asn Glu Ser Lys Asp Phe Val Arg Ala Gln Val Ile
 385 390 395 400

6

Thr Thr Arg Asn Thr Lys Arg Gly Trp Phe Asn Asp Trp Phe Thr Gly
 405 410 415

Gly Leu Asp Thr Gln Ile Glu His His Leu Phe Pro Thr Met Pro Arg
 420 425 430

His Asn Tyr Pro Lys Ile Ala Pro Gln Val Glu Ala Leu Cys Lys Lys
 435 440 445

His Gly Leu Glu Tyr Asp Asn Val Ser Val Val Gly Ala Ser Val Ala
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Val Val Lys Ala Leu Lys Glu Ile Ala Asp Glu Ala Ser Ile Arg Leu
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His Ala His

<210> 3

<211> 1467

<212> DNA

<213> Ceratodon purpureus

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<222> (10)..(1461)

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tgg agc aag tac agc gtg tac acc cat agc tat gct gga aac tat ggg 99

Trp Ser Lys Tyr Ser Val Tyr Thr His Ser Tyr Ala Gly Asn Tyr Gly

15

20

25

30

cct act ttg aag cac gcc aaa aag gtt tct gct caa ggt aaa act gcg 147

Pro Thr Leu Lys His Ala Lys Lys Val Ser Ala Gln Gly Lys Thr Ala

35

40

45

gga cag aca ctg aga cag aga tcg gtg cag gac aaa aag cca ggc act 195

Gly Gln Thr Leu Arg Gln Arg Ser Val Gln Asp Lys Lys Pro Gly Thr

50

55

60

tac tct ctg gcc gat gtt gct tct cac gac agg cct gga gac tgc tgg 243

Tyr Ser Leu Ala Asp Val Ala Ser His Asp Arg Pro Gly Asp Cys Trp

65

70

75

atg atc gtc aaa gag aag gtg tat gat att agc cgt ttt gcg gac gac 291

Met Ile Val Lys Glu Lys Val Tyr Asp Ile Ser Arg Phe Ala Asp Asp

7

80	85	90	
cac cct gga ggg acg gta att agc acc tac ttt ggg cgg gat ggc aca			339
His Pro Gly Gly Thr Val Ile Ser Thr Tyr Phe Gly Arg Asp Gly Thr			
95	100	105	110
gac gtt ttc gca aca ttc cat cca cct gcc gca tgg aag caa ctc aat			387
Asp Val Phe Ala Thr Phe His Pro Pro Ala Ala Trp Lys Gln Leu Asn			
	115	120	125
gac tac tac att gga gac ctt gct agg gaa gag ccc ctt gat gaa ttg			435
Asp Tyr Tyr Ile Gly Asp Leu Ala Arg Glu Glu Pro Leu Asp Glu Leu			
	130	135	140
ctt aaa gac tac aga gat atg aga gcc gag ttt gtt aga gaa ggg ctt			483
Leu Lys Asp Tyr Arg Asp Met Arg Ala Glu Phe Val Arg Glu Gly Leu			
	145	150	155
ttc aag agt tcc aag gcc tgg ttc ctg ctt cag act ctg att aat gca			531
Phe Lys Ser Ser Lys Ala Trp Phe Leu Leu Gln Thr Leu Ile Asn Ala			
	160	165	170
gct ctc ttt gct gcg agc att gcg act atc tgt tac gac aag agt tac			579
Ala Leu Phe Ala Ala Ser Ile Ala Thr Ile Cys Tyr Asp Lys Ser Tyr			
175	180	185	190
tgg gct att gtg ctg tca gcc agt ttg atg ggt ctc ttc gtc caa cag			627
Trp Ala Ile Val Leu Ser Ala Ser Leu Met Gly Leu Phe Val Gln Gln			
	195	200	205
tgt gga tgg ctt gcc cat gat ttc ctt cat caa cag gtc ttt gag aac			675
Cys Gly Trp Leu Ala His Asp Phe Leu His Gln Gln Val Phe Glu Asn			
	210	215	220
cgt acc gcg aac tcc ttc ttt ggc tat ttg ttc ggc aat tgc gtg ctt			723
Arg Thr Ala Asn Ser Phe Phe Gly Tyr Leu Phe Gly Asn Cys Val Leu			
	225	230	235
ggc ttt agt gta tca tgg tgg agg acg aag cac aac att cat cat act			771
Gly Phe Ser Val Ser Trp Trp Arg Thr Lys His Asn Ile His His Thr			
240	245	250	
gct ccg aat gag tgc gac gaa cag tac aca cct cta gac gaa gac att			819
Ala Pro Asn Glu Cys Asp Glu Gln Tyr Thr Pro Leu Asp Glu Asp Ile			
255	260	265	270
gat act ctc ccc atc att gcc tgg agc aag gaa att ttg gcc acc gtt			867
Asp Thr Leu Pro Ile Ile Ala Trp Ser Lys Glu Ile Leu Ala Thr Val			
	275	280	285
gag agc aag aga att ttg cga gtg ctt caa tat cag cac tac atg att			915

8

Glu Ser Lys Arg Ile Leu Arg Val Leu Gln Tyr Gln His Tyr Met Ile	
290 295 300	
ctg cct cta ttg ttc atg gcc cgg tac agt tgg act ttt gga agt ttg	963
Leu Pro Leu Leu Phe Met Ala Arg Tyr Ser Trp Thr Phe Gly Ser Leu	
305 310 315	
ctc ttc aca ttc aat cct gat ttg agc acg acc aag gga ttg ata gag	1011
Leu Phe Thr Phe Asn Pro Asp Leu Ser Thr Thr Lys Gly Leu Ile Glu	
320 325 330	
aag gga aca gtt gct ttt cac tac gcc tgg ttc agt tgg gct gcg ttc	1059
Lys Gly Thr Val Ala Phe His Tyr Ala Trp Phe Ser Trp Ala Ala Phe	
335 340 345 350	
cat att ttg ccg ggt gtc gct aag cct ctt gcg tgg atg gta gca act	1107
His Ile Leu Pro Gly Val Ala Lys Pro Leu Ala Trp Met Val Ala Thr	
355 360 365	
gag ctt gtg gcc ggt ttg ttg ttg gga ttc gtg ttt acg ttg agt cac	1155
Glu Leu Val Ala Gly Leu Leu Leu Gly Phe Val Phe Thr Leu Ser His	
370 375 380	
aat gga aag gag gtt tac aat gaa tcg aag gac ttc gtg aga gcc cag	1203
Asn Gly Lys Glu Val Tyr Asn Glu Ser Lys Asp Phe Val Arg Ala Gln	
385 390 395	
gtt att acc acc cgt aac acc aag cga ggc tgg ttc aac gat tgg ttc	1251
Val Ile Thr Thr Arg Asn Thr Lys Arg Gly Trp Phe Asn Asp Trp Phe	
400 405 410	
act ggg gga ctc gac acc cag att gag cat cac ctg ttt cca aca atg	1299
Thr Gly Gly Leu Asp Thr Gln Ile Glu His His Leu Phe Pro Thr Met	
415 420 425 430	
ccc agg cac aac tac ccc aag atc gca cct cag gtc gag gct ctt tgc	1347
Pro Arg His Asn Tyr Pro Lys Ile Ala Pro Gln Val Glu Ala Leu Cys	
435 440 445	
aag aag cac ggc ctc gag tac gat aat gtc tcc gtc gtt ggt gcc tct	1395
Lys Lys His Gly Leu Glu Tyr Asp Asn Val Ser Val Val Gly Ala Ser	
450 455 460	
gtc gcg gtt gtg aag gcg ctc aag gaa att gct gat gaa gcg tca att	1443
Val Ala Val Val Lys Ala Leu Lys Glu Ile Ala Asp Glu Ala Ser Ile	
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Arg Leu His Ala His	
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 <212> PRT
 <213> Ceratodon purpureus

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 35 40 45
 Thr Leu Arg Gln Arg Ser Val Gln Asp Lys Lys Pro Gly Thr Tyr Ser
 50 55 60
 Leu Ala Asp Val Ala Ser His Asp Arg Pro Gly Asp Cys Trp Met Ile
 65 70 75 80
 Val Lys Glu Lys Val Tyr Asp Ile Ser Arg Phe Ala Asp Asp His Pro
 85 90 95
 Gly Gly Thr Val Ile Ser Thr Tyr Phe Gly Arg Asp Gly Thr Asp Val
 100 105 110
 Phe Ala Thr Phe His Pro Pro Ala Ala Trp Lys Gln Leu Asn Asp Tyr
 115 120 125
 Tyr Ile Gly Asp Leu Ala Arg Glu Glu Pro Leu Asp Glu Leu Leu Lys
 130 135 140
 Asp Tyr Arg Asp Met Arg Ala Glu Phe Val Arg Glu Gly Leu Phe Lys
 145 150 155 160
 Ser Ser Lys Ala Trp Phe Leu Leu Gln Thr Leu Ile Asn Ala Ala Leu
 165 170 175
 Phe Ala Ala Ser Ile Ala Thr Ile Cys Tyr Asp Lys Ser Tyr Trp Ala
 180 185 190
 Ile Val Leu Ser Ala Ser Leu Met Gly Leu Phe Val Gln Gln Cys Gly
 195 200 205
 Trp Leu Ala His Asp Phe Leu His Gln Gln Val Phe Glu Asn Arg Thr
 210 215 220
 Ala Asn Ser Phe Phe Gly Tyr Leu Phe Gly Asn Cys Val Leu Gly Phe
 225 230 235 240

10

Ser Val Ser Trp Trp Arg Thr Lys His Asn Ile His His Thr Ala Pro
 245 250 255
 Asn Glu Cys Asp Glu Gln Tyr Thr Pro Leu Asp Glu Asp Ile Asp Thr
 260 265 270
 Leu Pro Ile Ile Ala Trp Ser Lys Glu Ile Leu Ala Thr Val Glu Ser
 275 280 285
 Lys Arg Ile Leu Arg Val Leu Gln Tyr Gln His Tyr Met Ile Leu Pro
 290 295 300
 Leu Leu Phe Met Ala Arg Tyr Ser Trp Thr Phe Gly Ser Leu Leu Phe
 305 310 315 320
 Thr Phe Asn Pro Asp Leu Ser Thr Thr Lys Gly Leu Ile Glu Lys Gly
 325 330 335
 Thr Val Ala Phe His Tyr Ala Trp Phe Ser Trp Ala Ala Phe His Ile
 340 345 350
 Leu Pro Gly Val Ala Lys Pro Leu Ala Trp Met Val Ala Thr Glu Leu
 355 360 365
 Val Ala Gly Leu Leu Leu Gly Phe Val Phe Thr Leu Ser His Asn Gly
 370 375 380
 Lys Glu Val Tyr Asn Glu Ser Lys Asp Phe Val Arg Ala Gln Val Ile
 385 390 395 400
 Thr Thr Arg Asn Thr Lys Arg Gly Trp Phe Asn Asp Trp Phe Thr Gly
 405 410 415
 Gly Leu Asp Thr Gln Ile Glu His His Leu Phe Pro Thr Met Pro Arg
 420 425 430
 His Asn Tyr Pro Lys Ile Ala Pro Gln Val Glu Ala Leu Cys Lys Lys
 435 440 445
 His Gly Leu Glu Tyr Asp Asn Val Ser Val Val Gly Ala Ser Val Ala
 450 455 460
 Val Val Lys Ala Leu Lys Glu Ile Ala Asp Glu Ala Ser Ile Arg Leu
 465 470 475 480
 His Ala His

<210> 5

<211> 520

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<212> DNA

<213> Ceratodon purpureus

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aattttgcga gtgcttcgat atcagcacta catgattctg cctctattgt tcatggccccg 180
gtacagttgg acttttggaa gtttgctctt cacattcaat cctgatttga gcacgaccaa 240
gggattgata gagaagggaa cagttgcttt tctactacgcc tggttcagtt gggctgcgtt 300
ccatattttg ccgggtgtcg ctaagcctct tgcgtggatg gtagcaactg agcttgtggc 360
cggtttggtg ttgggattcg tgtttacgtt gagtcacaat ggaaaggagg ttacaaatga 420
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caacgattgg ttcactgggg gactcgacac ccagattgag 520

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<211> 173

<212> PRT

<213> Ceratodon purpureus

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20 25 30
Leu Ala Thr Val Glu Ser Lys Arg Ile Leu Arg Val Leu Gln Tyr Gln
35 40 45
His Tyr Met Ile Leu Pro Leu Leu Phe Met Ala Arg Tyr Ser Trp Thr
50 55 60
Phe Gly Ser Leu Leu Phe Thr Phe Asn Pro Asp Leu Ser Thr Thr Lys
65 70 75 80
Gly Leu Ile Glu Lys Gly Thr Val Ala Phe His Tyr Ala Trp Phe Ser
85 90 95
Trp Ala Ala Phe His Ile Leu Pro Gly Val Ala Lys Pro Leu Ala Trp
100 105 110
Met Val Ala Thr Glu Leu Val Ala Gly Leu Leu Leu Gly Phe Val Phe

12

115

120

125

Thr Leu Ser His Asn Gly Lys Glu Val Tyr Asn Glu Ser Lys Asp Phe
 130 135 140

Val Arg Ala Gln Val Ile Thr Thr Arg Asn Thr Lys Arg Gly Trp Phe
 145 150 155 160

Asn Asp Trp Phe Thr Gly Gly Leu Asp Thr Gln Ile Glu
 165 170

<210> 7

<211> 514

<212> DNA

<213> *Ceratodon purpureus*

<400> 7

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 catgttgcca gttcttcagt accagcacct attctttttg gttcttttga cgtttgcccg 180
 ggcgagttgg ctatttttga gcgcggcctt cactctcagg cccgagttga cccttggcga 240
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 ttatctgctc cccggatgga aaccagttgt atggatggtg gtcagcgagc tcatgtctgg 360
 tttcctgctg ggatacgtat ttgtactcag tcacaatgga atggaggtgt acaatacgtc 420
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Asp Glu Asp Ile Asp Thr Leu Pro Ile Ile Ala Trp Ser Lys Asp Leu
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Leu Ala Thr Val Glu Ser Lys Thr Met Leu Arg Val Leu Gln Tyr Gln
 35 40 45

13

His Leu Phe Phe Leu Val Leu Leu Thr Phe Ala Arg Ala Ser Trp Leu
 50 55 60

Phe Trp Ser Ala Ala Phe Thr Leu Arg Pro Glu Leu Thr Leu Gly Glu
 65 70 75 80

Lys Leu Leu Glu Arg Gly Thr Met Ala Leu His Tyr Ile Trp Phe Asn
 85 90 95

Ser Val Ala Phe Tyr Leu Leu Pro Gly Trp Lys Pro Val Val Trp Met
 100 105 110

Val Val Ser Glu Leu Met Ser Gly Phe Leu Leu Gly Tyr Val Phe Val
 115 120 125

Leu Ser His Asn Gly Met Glu Val Tyr Asn Thr Ser Lys Asp Phe Val
 130 135 140

Asn Ala Gln Ile Ala Ser Thr Arg Asp Ile Lys Ala Gly Val Phe Asn
 145 150 155 160

Asp Trp Phe Thr Gly Gly Leu Asn Arg Gln Ile Glu
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<210> 9

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<212> DNA

<213> *Ceratodon purpureus*

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gccattcgat ggcgtagcac gctctctgat tgcctaccag cactggacgt tttatccaat 180

aatggctggt gctcgggtga acctctttgc ccaatccctt ctagtactga cctcgaagaa 240

gcatgtgcca gacaggtggc ttgagctcgg tgctatcggg ttcttctacc tgtgggttctt 300

caccctcttg tcgtacctgc ccaactgcacc ggagaggctt gctttcgtcc ttgtcagttt 360

tgcagtgaca gggatccagc atgtacagtt ttgcctgaac cacttctcat cgccgggttta 420

tctaggacag ccgaagagca aggcttgggt tgaatctcaa gcacggggca ctctcaatct 480

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<210> 10

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<212> PRT

<213> Ceratodon purpureus

<400> 10

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 20 25 30

Ser Tyr Phe Tyr Glu Arg Val Met Pro Phe Asp Gly Val Ala Arg Ser
 35 40 45

Leu Ile Ala Tyr Gln His Trp Thr Phe Tyr Pro Ile Met Ala Val Ala
 50 55 60

Arg Val Asn Leu Phe Ala Gln Ser Leu Leu Val Leu Thr Ser Lys Lys
 65 70 75 80

His Val Pro Asp Arg Trp Leu Glu Leu Gly Ala Ile Gly Phe Phe Tyr
 85 90 95

Leu Trp Phe Phe Thr Leu Leu Ser Tyr Leu Pro Thr Ala Pro Glu Arg
 100 105 110

Leu Ala Phe Val Leu Val Ser Phe Ala Val Thr Gly Ile Gln His Val
 115 120 125

Gln Phe Cys Leu Asn His Phe Ser Ser Pro Val Tyr Leu Gly Gln Pro
 130 135 140

Lys Ser Lys Ala Trp Val Glu Ser Gln Ala Arg Gly Thr Leu Asn Leu
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Met Val Ser Gln Gly Gly

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Gly Leu Ser Gln Gly Ser Ile Glu Glu Asn Ile Asp Val Glu His Leu

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Ala Thr Met Pro Leu Val Ser Asp Phe Leu Asn Val Leu Gly Thr Thr

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Leu Gly Gln Trp Ser Leu Ser Thr Thr Phe Ala Phe Lys Arg Leu Thr

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act aag aaa cac agt tcg gac atc tcg gtg gag gca caa aaa gaa tcg 368

Thr Lys Lys His Ser Ser Asp Ile Ser Val Glu Ala Gln Lys Glu Ser

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Val Ala Arg Gly Pro Val Glu Asn Ile Ser Gln Ser Val Ala Gln Pro

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Ile Arg Arg Arg Trp Val Gln Asp Lys Lys Pro Val Thr Tyr Ser Leu

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aag gat gta gct tcg cac gat atg ccc cag gac tgc tgg att ata atc 512

Lys Asp Val Ala Ser His Asp Met Pro Gln Asp Cys Trp Ile Ile Ile

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110

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Lys Glu Lys Val Tyr Asp Val Ser Thr Phe Ala Glu Gln His Pro Gly

120

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Gly Thr Val Ile Asn Thr Tyr Phe Gly Arg Asp Ala Thr Asp Val Phe

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150

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Ser Thr Phe His Ala Ser Thr Ser Trp Lys Ile Leu Gln Asn Phe Tyr

155

160

165

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16

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Tyr Arg Glu Leu Arg Ala Leu Phe Leu Arg Glu Gln Leu Phe Lys Ser	
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Ser Lys Ser Tyr Tyr Leu Phe Lys Thr Leu Ile Asn Val Ser Ile Val	
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gcc aca agc att gcg ata atc agt ctg tac aag tct tac cgg gcg gtt	848
Ala Thr Ser Ile Ala Ile Ile Ser Leu Tyr Lys Ser Tyr Arg Ala Val	
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Leu Leu Ser Ala Ser Leu Met Gly Leu Phe Ile Gln Gln Cys Gly Trp	
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Leu Ser His Asp Phe Leu His His Gln Val Phe Glu Thr Arg Trp Leu	
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Asn Asp Val Val Gly Tyr Val Val Gly Asn Val Val Leu Gly Phe Ser	
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Val Ser Trp Trp Lys Thr Lys His Asn Leu His His Ala Ala Pro Asn	
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Glu Cys Asp Gln Lys Tyr Thr Pro Ile Asp Glu Asp Ile Asp Thr Leu	
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Pro Ile Ile Ala Trp Ser Lys Asp Leu Leu Ala Thr Val Glu Ser Lys	
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Thr Met Leu Arg Val Leu Gln Tyr Gln His Leu Phe Phe Leu Val Leu	
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Leu Arg Pro Glu Leu Thr Leu Gly Glu Lys Leu Leu Glu Arg Gly Thr	
360 365 370	

17

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 Pro Gly Trp Lys Pro Val Val Trp Met Val Val Ser Glu Leu Met Ser
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 Gly Phe Leu Leu Gly Tyr Val Phe Val Leu Ser His Asn Gly Met Glu
 410 415 420

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 Val Tyr Asn Thr Ser Lys Asp Phe Val Asn Ala Gln Ile Ala Ser Thr
 425 430 435

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 Arg Asp Ile Lys Ala Gly Val Phe Asn Asp Trp Phe Thr Gly Gly Leu
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 Asn Arg Gln Ile Glu His His Leu Phe Pro Thr Met Pro Arg His Asn
 455 460 465 470

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 Leu Asn Lys Ile Ser Pro His Val Glu Thr Leu Cys Lys Lys His Gly
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 Lys Thr Leu Lys Asp Val Ala Asp Ala Ala Ser His Gln Gln Leu Ala
 505 510 515

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 Ala Ser
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Asn	Val	Leu	Gly	Thr	Thr	Leu	Gly	Gln	Trp	Ser	Leu	Ser	Thr	Thr	Phe
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Ala	Phe	Lys	Arg	Leu	Thr	Thr	Lys	Lys	His	Ser	Ser	Asp	Ile	Ser	Val
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				85					90					95	

Pro	Val	Thr	Tyr	Ser	Leu	Lys	Asp	Val	Ala	Ser	His	Asp	Met	Pro	Gln
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Asp	Cys	Trp	Ile	Ile	Ile	Lys	Glu	Lys	Val	Tyr	Asp	Val	Ser	Thr	Phe
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Ala	Glu	Gln	His	Pro	Gly	Gly	Thr	Val	Ile	Asn	Thr	Tyr	Phe	Gly	Arg
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Asp	Ala	Thr	Asp	Val	Phe	Ser	Thr	Phe	His	Ala	Ser	Thr	Ser	Trp	Lys
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Leu	Glu	Leu	Leu	Lys	Glu	Tyr	Arg	Glu	Leu	Arg	Ala	Leu	Phe	Leu	Arg
			180					185					190		

Glu	Gln	Leu	Phe	Lys	Ser	Ser	Lys	Ser	Tyr	Tyr	Leu	Phe	Lys	Thr	Leu
		195					200					205			

Ile	Asn	Val	Ser	Ile	Val	Ala	Thr	Ser	Ile	Ala	Ile	Ile	Ser	Leu	Tyr
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19

Lys Ser Tyr Arg Ala Val Leu Leu Ser Ala Ser Leu Met Gly Leu Phe
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 Ile Gln Gln Cys Gly Trp Leu Ser His Asp Phe Leu His His Gln Val
 245 250 255
 Phe Glu Thr Arg Trp Leu Asn Asp Val Val Gly Tyr Val Val Gly Asn
 260 265 270
 Val Val Leu Gly Phe Ser Val Ser Trp Trp Lys Thr Lys His Asn Leu
 275 280 285
 His His Ala Ala Pro Asn Glu Cys Asp Gln Lys Tyr Thr Pro Ile Asp
 290 295 300
 Glu Asp Ile Asp Thr Leu Pro Ile Ile Ala Trp Ser Lys Asp Leu Leu
 305 310 315 320
 Ala Thr Val Glu Ser Lys Thr Met Leu Arg Val Leu Gln Tyr Gln His
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 Leu Phe Phe Leu Val Leu Leu Thr Phe Ala Arg Ala Ser Trp Leu Phe
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 Trp Ser Ala Ala Phe Thr Leu Arg Pro Glu Leu Thr Leu Gly Glu Lys
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 Val Ala Phe Tyr Leu Leu Pro Gly Trp Lys Pro Val Val Trp Met Val
 385 390 395 400
 Val Ser Glu Leu Met Ser Gly Phe Leu Leu Gly Tyr Val Phe Val Leu
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 Ser His Asn Gly Met Glu Val Tyr Asn Thr Ser Lys Asp Phe Val Asn
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 Ala Gln Ile Ala Ser Thr Arg Asp Ile Lys Ala Gly Val Phe Asn Asp
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 Trp Phe Thr Gly Gly Leu Asn Arg Gln Ile Glu His His Leu Phe Pro
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 Thr Met Pro Arg His Asn Leu Asn Lys Ile Ser Pro His Val Glu Thr
 465 470 475 480
 Leu Cys Lys Lys His Gly Leu Val Tyr Glu Asp Val Ser Met Ala Ser
 485 490 495

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Gly Thr Tyr Arg Val Leu Lys Thr Leu Lys Asp Val Ala Asp Ala Ala
500 505 510

Ser His Gln Gln Leu Ala Ala Ser
515 520